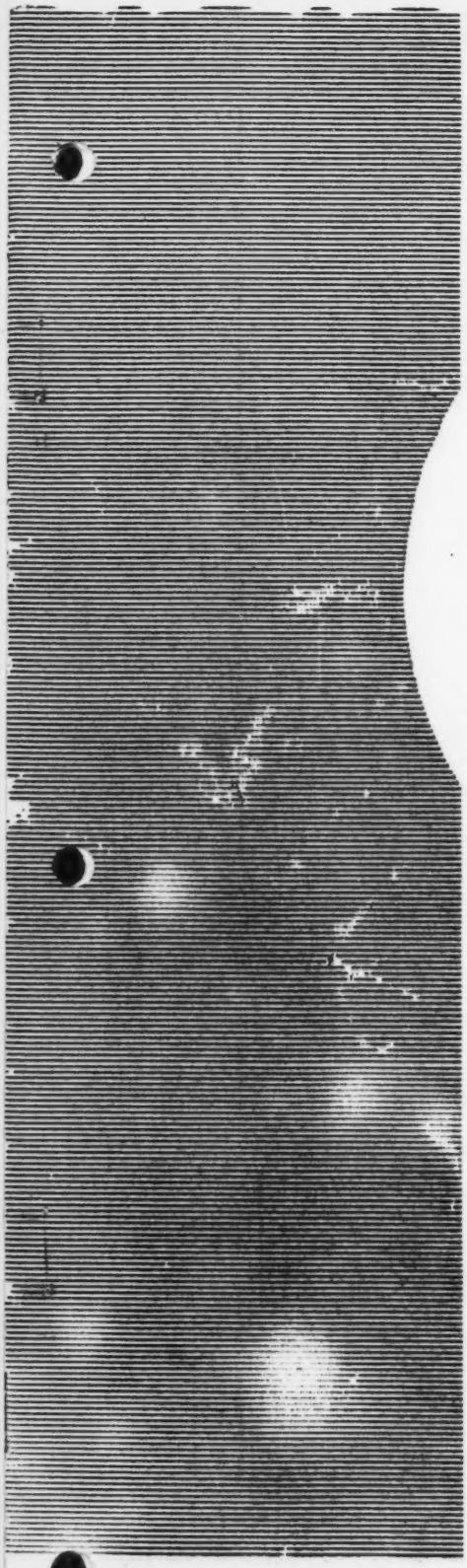

December 1962

NATIONAL DIGEST

Psychological Aspects of Disaster

Public Information

Mapping for Survival Operations

A School Built Underground

Nuclear Attack Hazard Probabilities

EMERGENCY MEASURES ORGANIZATION

THE EMO NATIONAL DIGEST

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The EMO NATIONAL DIGEST is published bi-monthly to provide current information on a broad range of subjects dealing with civil emergency planning. The magazine is published in English and French and may be obtained by writing to the Emergency Measures Organization, Privy Council Office, East Block, Ottawa.

In addition to publishing articles which reflect Canadian Government policy the Digest may also publish articles by private individuals on subjects of current interest to the emergency measures programme. The views of these contributors are not necessarily subscribed to by the Federal Government.

Director: R. B. CURRY. *Editor:* A. B. STIRLING.

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1962

Assessment of Nuclear Attack Hazard Probabilities

Part I of this article appeared in the October issue of the DIGEST. *In Part II Dr. James C. Pettee, who is Director, Analysis Division, in the U.S. National Resource Evaluation Center, Office of Emergency Planning, concludes his article with an examination of considerations relating to Weapon Effects.*

Part II—Technical Aspects of Calculating of Probabilities of Attack Hazard.

Weapon Effects

THE probability of damage or survival is based upon four weapon effects. An assessment of these is made at each geographical point under study. These four weapon effects, considered in the sequence in which their impact contributes to damage or survival at a point are: (1) blast overpressure; (2) fallout arrival time; (3) fallout radiation dose; and (4) fallout radiation intensity. Blast overpressure creates observable and immediate physical damage and casualties; fallout arrival time indicates a period in which potential victims of fallout would have time to take and/or improve shelter; fallout radiation dose provides the key to estimating radiation casualties; and fallout intensity is the basis for fixing the time of accessibility or denial by radiation of a facility or an area.

The basic probability expression used in the analytical procedure under discussion is stated in percent. This indicates the chances in 100 of this or that occurrence. The standard probabilities shown include 1, 5, 10, 15, 25, 50, 75, 85, 90, 95 and 99 per cent.

The direct effects from weapon detonations which are immediately destructive include direct gamma and neutron radiation, thermal radiation and blast overpressure. Both classes of radiation include some casualties over and above those inflicted by blast. The computer model for casualty estimation combines all three effects into an overall direct effects curve. This shows the percentage of casualties from all weapon effects at a given point, based on the distance, yield and height of burst of the dominant weapon for that point. A different but related overall direct effects curve shows the percentage of fatalities under the same circumstances. For each of these curves, there is a related set which gives corresponding estimates for other combinations of distance, yield and height of burst of a weapon for that point.

The blast effects on resources are assessed in terms of peak overpressure: a function of distance, yield and height of burst. The threat of fire is also indicated for resources which are susceptible to burning. This is done by indicating the incidence of thermal radiation capable of igniting kindling materials in areas of light blast overpressure. However, computer procedures are not available to assess the probability that fires actually will develop or spread with a measured increase of casualties and damage to resources.

Of all of the direct effects described above, the one that runs through all—both casualties and resource damage—and to which the others are roughly proportionate is the peak blast overpressure measured in pounds-per-square inch (PSI) pressure above normal atmospheric pressure. Accordingly, the probabilities for PSI overpressure are set forth as an indication of direct attack effect probabilities.

The amount of attack warning that could be anticipated or predicted ahead of the arrival of the first weapons is difficult to estimate; under some circumstances there very well might not be any such warning. For some of the population, however, there will be some lag time, constituting a warning time, between the time of the first weapon detonation which signifies the beginning of the attack and the local time of arrival of the first fallout. This time span will be a minimum warning period or lead time for taking additional protective measures, such as evacuation or emergency improvement activities, or at least for reaching shelter.

Since the effect of radiation exposure to animal life is cumulative, the expectation that fallout will induce radiation sickness or death in the population in a given instance is related to the accumulated dose which is

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measured in roentgens. The assessment of the dose in any given circumstance involves determining the initial radiation intensities from the contributing weapons, computing the first arrival times of the fallout relative to the time of detonation, and considering the length of time of exposure. For a particular point of interest, the computer derives the accumulated dose from the radiation dose rate (normalized for reference purposes to its H + 1 hr. rate — the level for one hour after detonation) and the time of first fallout arrival (measured from time of detonation). This determination is made for each weapon whose fallout reaches the point. The doses computed from individual weapons are then added directly to give the dose levels at the point which are shown on the maps and in the subsequent tables. The dose levels added are theoretical maxima, attained from several days to a few weeks after detonation, depending on the time of detonation and on the arrival time measured from detonation. The direct addition of doses from different weapons in effect ignores any differences in time of detonation of the contributing weapons, and treats the theoretical maximum doses as if they occurred simultaneously. Therefore, the dose levels shown on the maps and in the tables may slightly overstate the true maximum of the aggregated dose. Generally the overstatement does not exceed ten per cent of the dose and hence compares favorably with other uncertainties of fallout prediction.

The seriousness of the dose depends in the first instance on the intensity level, this is a function of the yield and wind speed which affect the density with which the fallout material will be deposited. Given the radiation intensity level at a particular point, the accumulated dose is also highly sensitive to the arrival time because the intensity is at its highest levels at these early hours. A rough but useful rule of thumb is that for each 7-fold increase in time there is a 10-fold decrease in intensity. Thus, seven hours after detonation the intensity will have decayed to approximately one-tenth of the H + 1 intensity. The range of difference in dose associated with difference in arrival time is apparent when one considers that, for example, the accumulated dose at the end of two weeks of exposure following an H + 49 hour arrival time would be about one-fifth of the two-week dose accumulation if that same fallout had arrived at H + 1 hour.

The third dimension to the magnitude of dose is the length of time over which exposure is measured. Theoretically, radiation from a given detonation would continue over a very long period of time. The fission fragments from nuclear weapons invariably include or evolve into some radioactive elements with exceedingly long half-lives. If all such radiation were to be counted, the result would be what is known as the infinite dose. Application of this concept would present practical problems of measurement because not too much is known of how much such material there might be. Furthermore, it would not be meaningful in predicting casualties because no one would be around long enough to get it all. Some more practical termination of the period over which dose is accumulated is required.

Actually, the body does recover from radiological exposure, though only partially, and at a slow rate. Nevertheless, if there is an overall recovery rate, and if the intensity level continues to decline as time passes, there will come a point in time when the number of roentgens being recovered from is as great as the number of roentgens being received. From this point on, the subject is safe from acute radiation sickness or death if he avoids new radiation sources. The total number of roentgens that constitutes the active threat, then, is the dose that should be measured to characterize the casualty threat. This is called the maximum Equivalent Residual Dose (ERD). The ERD at any point in time is defined as the total dose less biological recovery. When time is allowed to run to the point where new exposure is offset by recovery, the ERD is at its maximum. In defining ERD in these terms, the subcommittee of the U.S. National Committee on Radiation Protection provides that the measurement of biological recovery has a beginning 96 hours after exposure, a recovery half time of one month, 10 per cent allowance as irreparable damage and confining all possible recovery to that which would be accomplished under the foregoing within 90 days of exposure. This formula for the computation of biological recovery is approximated in the computer model with a rate of 2½ per cent per day recovery from the unrecovered dose for 90 days beginning 48 hours after exposure. The difference of two days in the commencement time of recovery makes less than 4 per cent difference in the resulting maximum ERD's computed in this study. This is the basis upon which the computer model calculates the maximum Equivalent Residual Dose.

Radiation intensity is the key to denial of sources. From the initial intensity is calculated the time one must wait for the normal of radiation to reduce the radiation rate to a tolerable level, before entering an area or emerging from shelter to establish or resume indefinite occupancy. Intensity at any point is stated in terms of a reference level of roentgens-per-hour as of one hour after detonation, whether the fallout material has arrived, or is still partially or wholly in the air at that hour. This is called the normalized H + 1 rate of fallout intensity. Thus, regardless of arrival time, the indicated intensity includes the radiation from all of

the fallout material destined for any given location. The intensity at any other time can be computed by the application of standard radiation intensity decay rates to the indicated H + 1 reference level.

These estimates of weapon effects are summarized in a variety of formats ranging from a detailed probability matrix for a specific geographic or resource location to broad summary tables which reflect probable damage and availability data for resources on a national or regional basis. It is these resultant estimates and summaries of the effects of a nuclear attack which provide a basis for planning improvements in the military and non-military defence posture.

Analysis of Attacks

Before estimating the effects of weapons, it is necessary to know the pattern in which they arrive, which in turn depends on the pattern in which the attack is launched. Therefore, a system is required for the analysis of attacks. The U.S. National Resource Evaluation Center (NREC) has devised a computer model called "Risk II" as the instrument for performing this line of analysis. Basically, the computer model consists of a gaming (Monte Carlo) program, point analysis programs and summary analysis programs.

The Monte Carlo program in the model provides the means of building up the probability values for all of the variable values in the study. The point experience analysis program provides the means of collecting the attack effects data at points of interest from the various different capability applications and thus to build up the probability distribution among the levels for each type of attack effect. The summary analysis procedure provides the means of integrating the probability of a selected aspect of experience for some type of resource or aspect of probability which would be useful for planning.

In the individual point analysis computations, the probabilities are computed independently for each point location. For the summary analysis, the probability is computed simultaneously and collectively for all points involved in the group being summarized. For example, if two resource points of equal value constituted a group and each had independently one chance in two of surviving, the group summary probability could be a half chance of no loss and half chance of total loss on the one hand or on the other hand the summary probability could be certainty of one-half loss. The difference lies in whether the individual losses are simultaneous or offsetting.

In the summary probability computations, for this line of analysis, simultaneity is accounted for; hence the summary probabilities computed for groups of resources indicate what the surviving situation for the group as a whole could be expected to be like, in the event of nuclear attack.

The Risk II Monte Carlo program games the attack input many times according to preassigned values for several attack variables, and produces a set of adjusted ground zeros for each trial. Pseudo-random numbers are generated inside the computer and introduced as the independent variables of mathematical operations testing them against preassigned probabilities of such attack variables as abort, attrition and aiming error. These procedures are repeated many times, producing for each trial a list of the weapons which penetrated the defenses and their points of detonation. Fallout winds are also gamed.

Attack input requirements include up to five execution options against each target. Position, height and yield of each intended burst, probabilities of abort and attrition, and probable radii of attrition and aiming error are included for each option. Wind input includes mean wind speed, direction and standard deviation for each season and each section of the earth's surface measuring ten degrees of latitude by twelve degrees of longitude.

Output of the program is an edited listing of the ground zeros selected for each trial specifying the coordinates of the detonation, height of burst, yield, time and wind to be used in the computation.

The Risk II Point Programs provide probabilities of various levels of damage and denial for each of a set of points. The Point Experience Program generates the levels of attack experience for each trial. The Point Analysis and Editing programs form tables of probabilities of attack experience and of damage and denial for individual points.

Input is the output from the Monte Carlo program and coordinates, physical vulnerability indices, names

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and locations of a physical increment of resource or personnel considered for an attack.

The output for each point may be a table of combined probabilities of any two of the four kinds of attack experience mentioned above, or independent probabilities, or probabilities of different levels of damage and denial.

Resource Analysis

The Risk II Summary Programs give a summary of probabilities of various levels of total damage to whole categories of resources. There is a choice of program models for deriving the summary analysis. One program, in effect, makes repeated runs of Streak IV (an NREC model for summary analysis of the effects from a single attack on a particular resource category) against the ground zeros of the several trials. The other programs derive the summary probabilities from the results of the point analysis program applied to all points involved in the category being summarized. The summary analysis and editing programs tabulate probabilities of various levels of damage to whole categories of resources.

Attack input to the summary program is the output of the Monte Carlo programs. Streak IV resource input is to be used in the summary program. The output for categories of resources tabulates the probabilities that the various levels of damage fall in certain intervals of percentages.

In the case-study analysis of a specific nuclear attack problem (whether hypothetical or real) the damage assessment estimation required for survival or recovery programming consists essentially of the application of weapons effects to the inventory of resources vital to survival and recovery. Subtraction of the damaged or denied resources from the pre-attack inventory constitutes a finding of resource availability by which is meant uninjured people capable of useful work, or accessible, operable production and service facilities, or accessible, usable inventories of goods.

The next step in the analysis of the post-attack problem is the preparation of supply-requirements determinations as needed to answer such questions as the adequacy of inventories to fill essential demands or whether the surviving facilities could be provided with the other essential ingredients of performance such as manpower, energy and raw materials. Still further analysis will be required to determine whether or how much performance should be programmed in a particular post-attack situation. This latter step would require a simultaneous determination of all elements of the input-output balance for the whole economy. The stated purpose of the line of analysis under consideration is to add the probability dimension to the analytical handling of the emergency program planning related to nuclear attack. At this stage, this can be done only for the damage assessment and, conversely, for the summary availability findings.

New extensions of present techniques or completely new departures will be required to carry the application of the probability dimension further along the sequence of analytical steps beyond damage assessment and resource availability determinations. A next step has already been conceptualized. It involves the concurrent application of probability to related categories of resources in such a way as to supply the probability spectrum for a subordinated category that is simultaneous with the probability spectrum for a controlling category. This would permit the application of the probability dimension to the analysis of a supply-requirement determination. For instance, if the available capacity of grain storage is taken as the measure of the supply and if the number of survivors is taken as the measure of requirements, the application of the probability dimension to the determination of the supply-requirement balance would require a finding of the probable level of grain storage capacity availability. This correlation would be accomplished with a finding of concurrent summary availability probabilities with grain storage as the controlling category and population as subordinate. Such a comparison would provide the best and worst prospective relationship between those categories which could be compared with a standard ratio which had been determined by other means to be the measure of the requirement for grain storage.

PUBLIC INFORMATION AND NUCLEAR WAR

The following article was prepared for publication in the CANADIAN ARMY JOURNAL *by Lt. Col. J. D. Donoghue, Public Information Officer, Emergency Measures Organization.*

PROVIDING INFORMATION to the public in peace and war has been recognized for centuries as a requirement by civil and military authorities. With the emergence of democracy the importance of an informed public was given new emphasis. If the people are to govern they must search out the true facts upon which to base judgments. And, when the facts are clouded and obscured and multiple choices are available to them, the public must be able to hear and read the varied prevailing opinions in order to decide and make known to their elected representatives the course they wish adopted.

The practice of informing the public has been confined neither to democracies nor modern times. Roman generals campaigning on the frontiers used courier-borne reports to ensure that details of their victories were proclaimed in Rome's market places. More recently, Hitler had his Goebbels. In sharp contrast, Winston Churchill dramatically and factually informed the public of the perils they faced and the sacrifices he was demanding. Also, during the Second World War, with government approval, the Allied Armed Forces organized extensive facilities to assist war correspondents in providing the public with information.

In peacetime, natural disasters repeatedly have illustrated the importance of informing the public. Many readers of the *Army Journal* will be personally familiar with the constant and heavy demand for comprehensive and accurate information to the public during natural disasters. Hurricane Hazel; the Manitoba Floods of 1950 and operations in 1948 when the Fraser River went on a rampage, illustrated this characteristic need for information. And the effectiveness with which it is provided can immeasurably assist those responsible for operations during natural disasters. In one such disaster a complete and frank situation report effectively delivered to the public by a Commander was judged to have had an immediate calming influence although the serious dangers still confronting the community were clearly stated.

The importance to defence of an informed public is even greater for nuclear than conventional war. And the need to inform the public on the subject will remain constant until such time as the climate for true peace has been developed universally and the control and inspection of arms has been accepted and effectively established. Unfortunately, those conditions do not exist today.

Technological progress has assisted efforts to ensure an informed public. It now is possible to provide an overwhelming mass of data, facts and opinions. Recently world-wide television programmes were seen and other revolutionary aspects in the field of communications were forecast by the highly successful project which placed the satellite TELESTAR in orbit.

But in the final analysis volume alone will not ensure that the public is informed. The effectiveness with which the public in the past and the future has and will be informed will vary primarily according to the integrity, honesty and skills in communication of the authorities providing the information and the writers and broadcasters who address themselves to the public.

Even with further technical improvements it will remain, as it is today, a most difficult task to ensure an informed public. Some facts will remain obscure, some truths unknown and some falsehoods circulated.

In addition to the difficulties inherent in ensuring an informed public and the complexities of the subject of nuclear warfare, there is no human experience in either short or long-term effects of a multi-megatons thermonuclear weapons attack. Despite these difficulties, an impressive amount of information based on the best scientific knowledge available has been prepared for the public by the Federal Government. The Emergency Measures Organization co-ordinates the programme by which this information is provided. EMO issues information on subjects for which it is responsible and co-ordinates the emergency measures public information activities of all federal departments. In addition, it provides public information assistance

to the provinces and through them to the municipalities.

In preparing the EMO public information plan the first step was to decide what information the public needed and the second step was to select the means by which that information would be provided.

It is not possible in this article to provide the details of all the emergency measures information now available to the public from the federal government. Therefore, in what is a necessary over-simplification, the information being provided can be summarized as follows:

The current threat of nuclear war; the effects of nuclear war upon Canada and its people; federal government emergency plans and preparations and advice to individuals and families regarding peacetime survival preparations they can make for their own protection.

A major means of providing this information has been the publication of pamphlets and leaflets. One series of pamphlets is subtitled *Blueprint for Survival.* This series as well as other EMO publications was described in the June, 1962, edition of the *EMO National Digest.*

The information contained in the publications is as factual as present knowledge permits. Prior to publication drafts of each are reviewed by scientists and technical experts qualified in the particular subject and every effort is made to present the information in language that will be understood by the public.

All of the publications are available free and a letter addressed to **EMO, Box 10,000,** in the Capital City of the writer's Province, will bring a copy.

Newspapers, radio and television stations also have been a major means by which emergency measures information has been made available. Many newspapers reprinted in full such pamphlets as *11 Steps to Survival* and broadcasting stations have presented many major productions on the subject.

As stated earlier, federal departments having major emergency measures responsibilities are responsible for preparing and issuing public information on the subject. For example, the Army supplies the information on its survival role. Also, the Department of Agriculture, in consultation with the Emergency Measures Organization, prepared, published and distributed the pamphlet *Fallout on the Farm.* The principle has been adopted that each department is responsible for all public information aspects arising from its emergency measures responsibilities. The Emergency Measures Organization co-ordinates departmental public information in order to prevent duplication and ensure conformity with policy and fact.

Besides the current public information plan, the Emergency Measures Organization also is responsible for developing and co-ordinating an operations plan for public information that would be brought into use in the event of a real emergency. In an attack on Canada, conventional or nuclear, dissemination of information to the public would be seriously disrupted. But at the same time it would be essential to quickly provide the public with information, instructions and advice, thereby reducing confusion and giving the people the incentive to survive and assist the country in recovering from the attack.

Here, too, it would be important to decide what information the public needed and the means by which it would be provided. With respect to the former, it is essential to distinguish between the two general types of information which may be defined as:

(a) *Public Information*—is information on the activities of our nation, allies and enemy in wartime that will maintain the will of the people to survive, help others survive and thereby assist in the country's recovery.

(b) *Warnings, Instructions and Advice*—to the public requiring or recommending action by them in an emergency.

In planning, the principle has been accepted that every available operating means of passing information to the public would be used.

The quickest possible warning followed by instructions and advice to the public would be essential in the event of a threat of imminent attack on North America. Broadcasting stations provide the fastest means of disseminating information and for this reason an Emergency Broadcasting Plan, developed, organized and operated by the Canadian Broadcasting Corporation has been prepared.

The plan resulted in the formation of the Emergency Broadcasting Network in which all radio and television stations in Canada, with the exception of some northern stations, will participate. The network itself is connected by teletype communications to the Army's Attack Warning System. In fact, the sounding of the ALERT warning on the system's sirens, means the government expects an imminent attack on North America and that the public should listen to the radio for instructions.

The Emergency Radio Network would be available for public information probably in newscast format as well as broadcasts by the Prime Minister and other senior representatives of government.

The printed as well as the broadcast word is included in the operations plan for public information. Provision is being made for the presence of Canadian Press and United Press International representatives,

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MAPPING FOR SURVIVAL OPERATIONS

Prepared by the Directorate of Military Survey,
Army Headquarters, Ottawa.

MAPS are essential to the conduct of all military operations. In the case of National Survival this need for maps falls in two categories:

1. The pre-attack phase when re-entry planning would be done and a resources inventory made, and
2. The post attack phase during re-entry operations.

The re-entry use of maps is similar to that of any other military operation. However, the pre-attack analysis of each target city is new, and possibly needs some elaboration. As can be imagined, a wide variety of supplies and resources is needed in re-entry operations. Their location must be known and their acquisition must be almost immediate. Some items in the list of stores required are obvious; food, clothing and shelter are in this category. But if careful thought is given to the situation it will be realized that additional supplies such as vehicles, engineer equipment, medical supplies etc., will be needed, and the source location must be known. In short, the location of all sorts of facilities such as doctors' offices, nursing homes, used car lots, construction contractors' yards, etc., must be plotted and recorded; and the obvious method is to use the Universal Transverse Mercator (UTM) coordinate system on the standard military map. The UTM coordinates of each type of supply can be stored in electronic data processing systems for quick tabulation and presentation.

In addition to resources plotting a physical analysis of each city is necessary in pre-attack planning. The density of buildings, the probable location of rubble lines, areas of buildings where total roof area is above a given per cent, and many of the other physical characteristics of a target city must be located and plotted on a map. Again the need for up-to-date gridded maps is apparent.

Shortly after the Canadian Army was given the responsibility for re-entry, the available maps of the sixteen target cities were examined by the Directorate of Military Survey. Military maps at 1:50,000 and 1:250,000 existed for most of the target areas, but because the Defence Mapping Plan had for many years stressed the need for more work in the North, maintenance of maps of settled areas had been neglected. Consequently it was found that both of these map series were seriously in need of revision. Further it was found after study that the detail possible at 1:50,000 was inadequate for operations in urban surroundings.

Town plans of some sort existed for each of the target cities. In general these varied from the completely unsuitable to moderately useful. They tended to be at odd scales (too large for handling in the field or too small for legibility) and to be restricted to a part only of a given target area. In every case they lacked a grid referencing system compatible with the maps of the surrounding country.

After research it was decided that the optimum scale would be 1:25,000. This scale was large enough to show major buildings like schools and warehouses, yet small enough in scale for areas of a convenient working size to be mounted on a single map board. Further it was decided that both the standard 1:25,000 map and a special military town plan at the same scale would be needed.

In the spring of 1960 arrangements were made for the Army Survey Establishment field parties to start the work for the ground control necessary for the plotting of 1:25,000 maps of Toronto, Hamilton, Niagara Falls, London, Windsor, Montreal and Quebec City. The Topographical Survey, Department of Mines and Technical Surveys, was asked for assistance and agreed to do the field work in Calgary, Edmonton, Winnipeg, St. John's, Newfoundland, Saint John, New Brunswick and Halifax. The field work for Victoria and Vancouver had already been done in an experimental urban mapping project that the Army Survey Establishment had started long before the need for Survival mapping became apparent.

Compilation of the maps was of course done by photogrammetric methods. Air photography of the cities was ordered to be flown at 12,500 feet above ground which gave a photo scale of 1:25,000. This was considered the optimum for the photo interpretation and compilation that followed. Responsibility for the actual compilation was divided between the Army Survey Establishment and Topographical Survey, M & TS.

The initial deadline given by the Directorate of

Survival Operations was that 1:25,000 coverage should be available of at least the built-up areas of all target cities by 1 November 61. To accomplish this task it was apparent that provisional maps would have to be issued in the first instance. These were black and white maps made from the initial photogrammetric manuscripts. The UTM grid and a few of the more important street names were overprinted in magenta.

By 1 November 61 coverage of all cities excepting Hamilton was available. In the case of Victoria, Vancouver and Calgary the standard 1:25,000 maps were published; in the other cities provisionals had been provided, and for Hamilton a commercial town plan was overprinted with the UTM grid as a substitute.

The design of a military town plan specifically tailored to Survival operations proved a very interesting operation. What was needed was an up-to-date map showing all the streets by name, the location of important municipal service centres such as police stations, fire stations and hospitals; the location of municipal centres which would have to be closed down in the case of disaster such as electrical sub-stations, natural gas pumping stations; and the location of services which would have to be restored as quickly as possible to rehabilitate the area, such as sewage pumping stations, water supply facilities and so on.

The General Staff requirement as stated was flexible enough to leave all the major cartographic decisions to the Army Survey Establishment. It might be looked upon as the cartographer's dream, because in this case there was no established precedent to follow; in fact, the ASE was given a blank sheet of paper and told to get on with the job. The only restraint was that the provisions of the STANAG (NATO Standardization Agreement) on Military City Maps (STANAG 2218) be adhered to. In actual fact this STANAG proved more of an aid than a hindrance as it outlined in some detail the normal requirements of military town plans. These served as a very useful check list.

From the beginning it was recognized that the marginal information would have to be considerably more extensive than that on a normal topographic map. The alphabetical list of street names together with the military grid reference of their location on the map face was one notable addition. Another was the numbered guide to all buildings and installations of military or civil defence importance. When the actual map design was begun it was found that these inclusions had generated a series of cartographic problems.

The most important of these problems was the question of general sheet layout. The scale of each map would be 1:25,000, as mentioned earlier, but as the cities varied in size from three miles across in the case of St. John's, Newfoundland, to 25 miles across in the case of Toronto, it was obvious that the general layout of these maps would vary considerably. It was decided that two sheet sizes only would be used—22 x 29½ and 31 x 48 inches. The size to be used would be determined by the overall size of the town plan layout and if space permitted the "Street Guide" and "Guide to Numbered Features" would be shown on the map; otherwise they would be printed on the reverse side. Plans of the very large cities, such as Montreal and Toronto, would be divided into two sheets and designated as "East" and "West", with an overlap along the common edge.

In this series the industrial areas appear in a grey tint and the built-up residential areas in a pink tint.

The total list of colours is as follows:

Culture and Names—black.
Drainage—dark blue.
Open water—light blue.
Contours—brown.
Vegetation—green.
Industrial areas and municipal boundaries—grey.
Road fill—red.
Residential—pink.
Military grid—purple.
Numbered buildings—magenta.

When this project was underway still another was started. This was the production of Survival Operations Plotting maps at a scale of 1:12,500. These maps were required for the plotting of detailed resources studies. For instance, the location of retail drug stores is important, but in certain areas they may occur so close together that they cannot be shown clearly at 1:25,000. The plotting maps are actually a "blow-up" of the 1:25,000 maps printed in a non-photographic blue. Any markings made on the plotting chart by Target Area Headquarters personnel, Emergency Measures Organization researchers or field men can be taken off by photography and overprinted on stock maps for distribution. This is a very fast process and does not require laborious drafting.

Finally the problem of revision must be met. Although the 1:25,000 series is considered the optimum scale for most survival operations, the 1:50,000 and 1:250,000 series have important uses. A project is now underway in the Army Survey Establishment to revise these scales to conform to the new 1:25,000 maps. Due to the explosive rate of growth of most Canadian cities, city maps become obsolete very quickly. A case could be made for annual revision, but the cost would be prohibitive. After careful study it was decided that maps of all scales will be revised on a six-year cycle.

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MANITOBA REGULATION 90/62

being

A Regulation Under The Education Department Act
respecting Emergency Measures In Schools

1. In this regulation,
   (*a*) "alarm signal" means a steady siren signal of three to five minutes duration;
   (*b*) "bus" means a school bus, as defined in The Highway Traffic Act;
   (*c*) "co-ordinator" means the civil defence co-ordinator as defined in The Civil Defence Act;
   (*d*) "district" means a school district, school area or school division formed under The Public Schools Act;
   (*e*) "school" means a school operated under The Public Schools Act;
   (*f*) "take cover" signal means a siren characterized by a series of rising and falling blasts.

2. Where, in the event of an emergency, existing or threatened, the minister has ordered a school to be closed, he shall forthwith communicate his order to the co-ordinator and to
   (*a*) the superintendent of schools having jurisdiction over the school; or
   (*b*) where there is no superintendent of schools, the school inspector having jurisdiction over the school.

3. (1) Each superintendent of schools and each school inspector, on receipt of an order made under section 2, shall forthwith transmit the order to the principal of the school.
   (2) The co-ordinator, on receipt of an order made under section 2, shall forthwith transmit the order to the zone controller in whose territory the school is located.

4. (1) On receipt of an order made under section 2 or where an alarm signal is sounded each school principal, subject to section 5, shall order forthwith the evacuation of the school, employing one or more of the following means:
   (*a*) where a public address system is installed, by pre-arranged message;
   (*b*) where a mechanical bell system is installed, by a pre-arranged distinctive signal;
   (*c*) where neither of the methods set out in clauses (*a*) and (*b*) are available, by any reasonable method pre-arranged by the principal with his staff.
   (2) Subject to section 5, the order of the principal for evacuation of the school shall include an instruction to the pupils to proceed forthwith to their respective homes.

5. (1) Where bus transportation to and from school is provided by the district, except where section 7 applies, the principal shall
   (*a*) on receipt of any order made under section 2 forthwith notify the drivers of all buses providing such transportation;
   (*b*) notwithstanding subsection (2) of section 4, but subject to subsection (2) of this section, cause those pupils who are transported by bus to remain at the school under his supervision or that of a designated member of his staff, until their respective buses arrive at the school.
   (2) Where, in the opinion of the principal, it is not possible to provide transportation under subsection (1) within a reasonable time after receipt of the order, the principal may dismiss all or any of the pupils and instruct them to proceed forthwith to their respective homes.

6. (1) Subject to this regulation and to the instructions of the school board and where applicable, the superintendent, the principal shall
   (*a*) establish a definite procedure for the orderly evacuation of the pupils of the school to be followed if he receives an order made under section 2 or if an alarm signal is sounded;
   (*b*) post a notice setting out the required procedure in a conspicuous place in the school;
   (*c*) arrange for and hold evacuation drill (short of actual dismissal) in the school not less frequently than three times a year, at times specified by the superintendent, or if there is no superintendent, by the principal; and
   (*d*) where bus transportation is provided, maintain a list of bus drivers serving the school, together with their home or business addresses and telephone numbers.

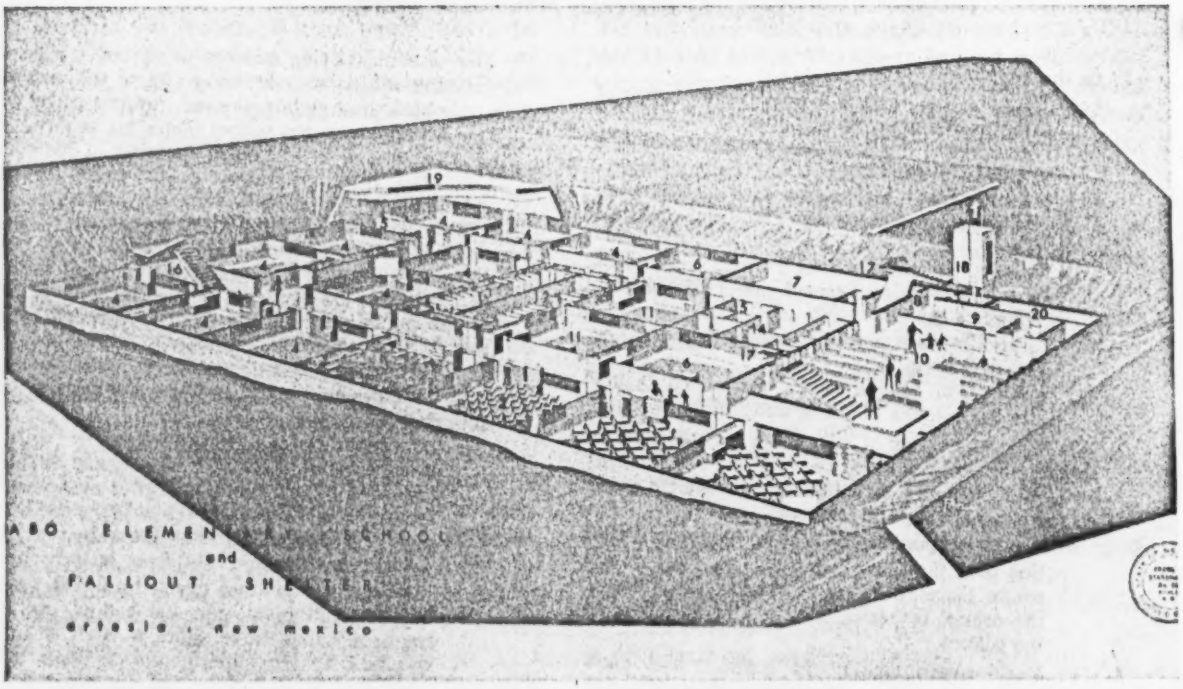
7. Notwithstanding any other section of this regulation, if a take cover signal is given while schools are in operation, the principal shall take appropriate action forthwith to provide maximum safety for his pupils within the school premises.

8. To provide maximum safety in case of a take cover signal the board of trustees of every district shall forthwith after the publication of this regulation
   (*a*) devise a plan for the maximum possible protection of the pupils within each of the schools under its jurisdiction; and
   (*b*) submit a copy of the plan to the Department of Education.

9. Immediately after publication of this regulation and annually thereafter, in the month of September, notify the parents of each of the pupils of the action that will be taken by the superintendent or inspector and the principal in the event that an order is made under section 2, or that an alarm signal or a take cover signal is given.

10. To facilitate procedures outlined in this regulation the minister may require any school board to instal special emergency equipment in schools under its jurisdiction.

A SCHOOL BUILT UNDERGROUND



1. Classrooms, normal conditions (lower right-hand corner). 2. Seating for fallout condition. 3. Classroom converted to sleeping quarters. 4. Empty classroom*. 5. Teaching aids spaces. 6. Empty classroom*. 7. Mechanical room. 8. Food storage, normal conditions; morgue, fallout conditions. 9. Kitchen. 10. Multipurpose room, normal; dining room, fallout conditions. 11. Classrooms, normal; infirmary, fallout conditions. 12. Men's toilet, shower. 13. Women's toilet, shower. 14. Administrative offices. 15. Nurse's station, normal; isolation, fallout conditions. 16. Cot storage. 17. Vertical access, air intake, service complex. 18. Service elevation. 19. Survival food storage.

* Will serve same normal and emergency use as classrooms No. 1.

At the new Abo school in New Mexico, the first school to be built underground in the United States, students go on the roof to play, and underground to study.

The school, which can be utilized as a shelter for 2,100 people, accommodates 550 pupils from grades one to six and provides an ideal educational climate based upon good lighting and acoustics, fixed room temperatures and the elimination of distracting noises. In addition all walls in each classroom are available for teaching purposes.

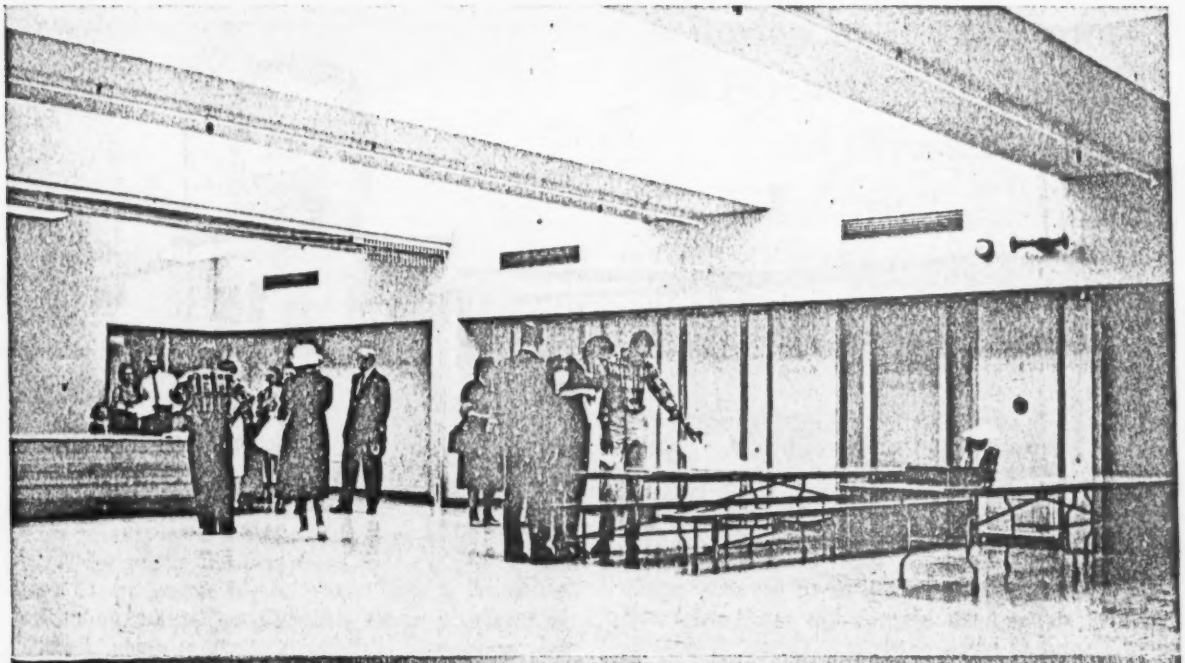
Engineers estimate the underground school will cost half as much to operate as a conventional air-conditioned school.

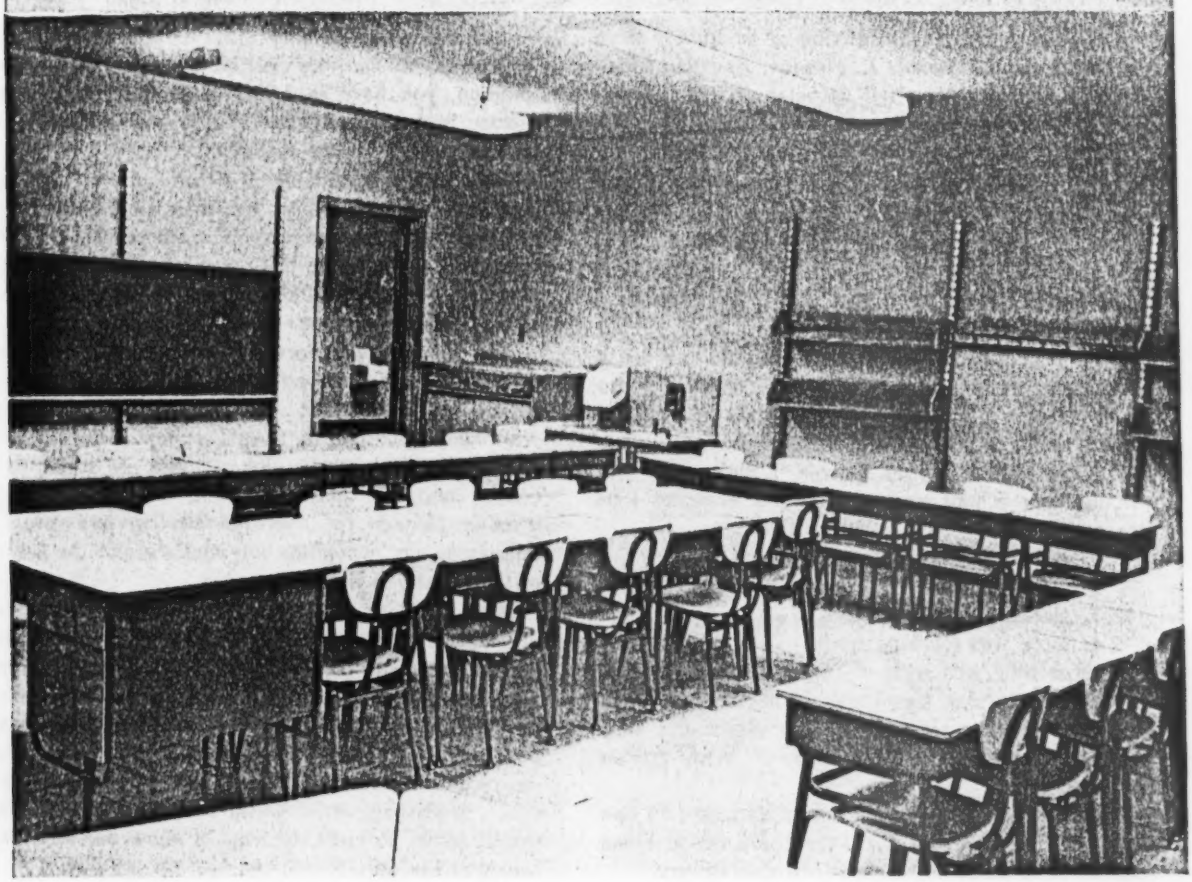
Viewed from the top, the school appears as a concrete slab 200 feet long and 145 feet wide marked off for a basketball court. Three corners of the slab have brick entrances opening onto stairways going down to the classrooms.

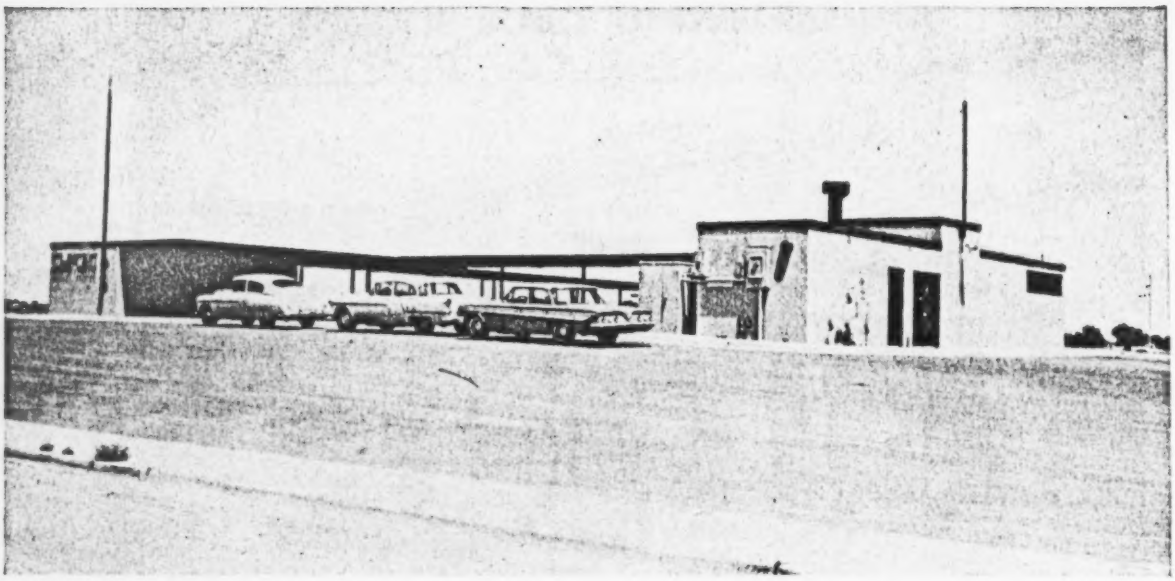
Once below, the students are surrounded by walls and furniture painted bright cheerful colors and rooms bathed in plenty of light. Each room has a built-in projection screen and its own movie and slide projectors and tape recorders.

To make ready for a disaster, emergency food, medical supplies, cots and blankets are to be stored in the school. In event of an attack, rooms could be converted into sleeping areas, infirmaries and recreation rooms.

The shelter's capacity is determined not by food or space available but by air-conditioning. Without artificial cooling, temperatures inside the building would rise to 145 degrees. To provide for any emergency the school is equipped with a diesel-powered generator. When the regular electricity is interrupted, the stand-by generator automatically takes over. Enough fuel is buried in a tank nearby to run the engine for four weeks.







The following is a condensation of an address given by the Honorable Steuart L. Pittman, Assistant Secretary of Defense for Civil Defense at the school's dedication ceremonies, Artesia, New Mexico, June 12, 1962.

"The capacity of your School Board and school administration to pioneer in designing new environments for education is one of the qualities which would make our country an impossible target for any rational aggressor. It is also the quality that makes possible a realistic civil defence programme.

Abo School is designed as a school, not as a shelter. Its design came about as a result of your highly successful experience with two windowless schools and a careful study of the conditions and costs that make sense for your schools. I understand that placing your school underground has achieved four things:

1. Better control of air conditioning,
2. better learning conditions, fewer distractions,
3. glareless lighting, and
4. more wall teaching space.

In more congested areas, the success of your experiment has particular significance. The availability of ground level play areas above the classrooms may warrant the moderate extra cost of below-ground construction.

The Federal Government became interested in this project after your School Board decided, for educational reasons, in favor of advanced windowless designs.

Although your primary purpose was to make the best classroom facilities possible for about 540 school children, you have in addition, at slight extra cost, created in your community a capacity to shelter 2,100 persons against fallout radiation.

The underground school which we see here in Artesia is a unique project. But there are a surprisingly large number of unique projects which provide valuable data and experience for the growing body of knowledge about how to improve buildings so that they can protect against fallout radiation.

The design of your forward-looking architects, made possible by the alert and open minds of your School Board Administrator, is particularly important because school construction is the largest element in the Nation's new institutional construction. Schools are community centres and will play their role in an emergency, whether planned or otherwise. Furthermore, over a quarter of our population are students and the future of the country is tied to their fate.

Here in Artesia, we see the challenge that the nuclear age presents to every town. It has been met by an intelligent and pioneering response. When we consider the grim details of the possibility of a thermonuclear war by miscalculation, it is no answer to say this presents problems too difficult to meet, to say that the results are too frightening and so abandon ourselves to despair. In a world so small with uncontrolled forces so great, we cannot allow ourselves the luxury of inaction."

A Review of the Literature on Psychological Aspects of Disaster

Part II

In Part II of this article the author, Morgan Martin, M.D., M.Sc., Chief, Mental Health Division, Department of National Health and Welfare, concludes his paper on the psychological aspects of disaster.

Evacuation of Populations

MASS EXODUS and evacuation have been major features of all community disasters from the hurricane or the flood to the atomic bomb. Where there is disorderly evacuation and particularly where escape is delayed or blocked, panic is likely to develop. Evacuation and temporary shelter should be provided in such a manner that the family life, and routine but meaningful activity, can be restored as soon as possible.

Factors mitigating against evacuation from a threatened area include desire to remain with and protect property, fear of loss of revenues from closing businesses, desire to stay with other persons who do not intend to evacuate, belief that one's own situation is safe . . . and a tendency to mistrust or discount the competence of the authorities issuing warning.

Children

Special comments should be made about children. The most important thing to realize about children exposed to bombing is that it is (often) more traumatic for a child to be suddenly separated from the mother, than it is to be bombed. . . . Any plan for evacuation of children in the event of a disaster should bear in mind the trauma of sudden separation from parents.

It has been consistently observed that separation from parents and the behaviour and reactions of parents, are crucial factors in determining the reactions of children to disaster. The most severe features of war for children in the U.K. psychologically were not the bombing and sights of destruction and injury, but the problems of evacuation, displacement from the familiar, and separation from the parents. The children appear to experience the dangers not directly but as mediated by significant adults upon whom they depend.

This evacuation (of children) should be carried out recognizing that more psychological damage sometimes occurred to children in England during World War II due to the evacuation than would have taken place had the children been left in the danger area. . . It appears evident that children can withstand the stresses of a danger situation much more readily than the separation from home and parents. Bearing this in mind, mothers or substitute mothers should be provided and the new home should approximate the old as nearly as possible.

Convergence Behaviour

One of the central problems of disaster co-ordination and control derives not from the victim population itself, but from the informal, spontaneous, convergence action of persons residing outside the disaster area. . . Movement toward the disaster area is both quantitatively and qualitatively greater than flight or evacuation from the scene of destruction.

In virtually every disaster studied, the informal convergence on the disaster area and the uncoordinated mass assault on the problems posed by the disaster have seriously hampered the administration of organized rescue, medical, emergency, relief, and rehabilitation programs.

Effective control of the convergence process requires positive action to allay the anxiety over missing loved ones and the desire to assist the stricken population.

Spontaneous Group Formation

Catastrophe leads to the development of strong feelings of dependency. People exhibit a strong need to be with others, and there is a momentary disappearance of the usual social barriers.

The net result of most disasters is a dramatic increase in social solidarity among the affected populace during the emergency and immediate post-emergency periods. The sharing of a common threat to survival and the

common suffering produced by the disaster tend to produce a great outpouring of love, generosity, and altruism.

Outside persons or agencies (should) adjust to the local sentiments of solidarity and enable the local populace to pursue their self-determined course of action.

Leadership

Group morale is fostered by organizations and effective leadership.

Leaders who emerge following a catastrophe play an important and vital role in recovery. They provide energetic and decisive leadership at a time when it is most needed; can galvanize their communities into constructive activity, or can provide an effective liaison between (relief) organizations coming in from the outside and the local populations.

It has been pointed out that the group of survivors itself will select leaders spontaneously from the "cool and collected" persons.

It is therefore most appropriate that disaster personnel should be knowledgeable concerning the psychological aspects of disaster since under such circumstances they would be expected not only to participate in any treatment program but in addition to play the role of leaders.

Those of us who will be community leaders in the event of a disaster must set an example.

Need for a Registry

Uncertainty over the fate of loved ones creates great anxiety and intensive search efforts which often interfere with the performance of more general community-orientated tasks. There is a need for a central registry where the names of survivors could be found.

In order to prepare for the possibility of nuclear warfare a registrar should be in existence with sufficient assistants so that one can determine the location of individuals. An information center which will collect data about casualties without any delay should be set up. Plans for this should be made immediately since more panic is likely to occur due to worry about relatives, than concerning the danger to oneself.

Rumour Formation

Rumour formation is one direct consequence of false and inadequate communication. The provision of factual information rapidly, directly, and to the right place is, therefore, essential. Rumours may be expected as the outcome of needs to express hostility. This hostility is quite common in catastrophe, for most people feel that someone must be at fault. Rumour also develops because some people try to justify their own behaviour, to give the event concrete dimensions, and to reduce it to something that can be understood.

As a rule the best method of dispelling rumours . . . is to maintain a constant flood of accurate information to the civilian population.

Disaster Management

The central task of disaster management in the immediate post-emergency period is to broaden people's focus of attention and re-establish general, co-ordinated individual and small group actions. The accomplishment of this task requires speedy and accurate reconnaissance, a competent intelligence network, and the capability of disseminating information and instructions to a wide segment of the surviving population.

Most of the human problems of disaster originate in the lack of co-ordination among the great mass of people, small groups, and official disaster agencies. Each of these is viewing the disaster in terms of its own perspective and capabilities. When there is no practiced plan of action which fits into an organized overall disaster plan, behaviour tends to be too limited in scope and too much dominated by the immediate present to provide for the continuing human needs.

Recoil Period

During the period of recoil, the majority of survivors achieve their first awareness of what has just happened. They begin to move toward each other for mutual protection and emotional support against the common enemy. This unity creates a powerful influence on effective functioning. The group may be able to sustain the individual and also act as a powerful motivation for unselfish behaviour.

The period of recoil varies from several hours to several days . . . There is a gradual return of self-consciousness and awareness of the immediate past. It is the period during which, for the majority, the first overt emotional expression occurs. There is a need to "ventilate" during this period, to get angry at someone or to express oneself in some way. The need to ventilate is associated with a childlike attitude of dependency, which is an essential ingredient of this phase.

Persons faced with common danger tend to unite for mutual protection. During this period emotional bonds develop that shatter prejudices and barriers.

Both the character of individual responses during this period and their management by personnel engaged in rescue and relief would appear to have a crucial significance for subsequent psychological events.

Obviously the person who becomes unable to fend for himself during the immediate period following a catastrophe must be cared for. There is evidence which would indicate that it is not a very big problem.

Post-Traumatic Period

This phase begins when the overt danger from the disaster agent has passed and when the environment is no longer immediately threatening but has again become predictable. During this period organized planning is possible. Effective action may be delayed because communication is faulty.

The post-traumatic period is characterized by the first full awareness of what the disaster has "meant" in terms of loss of home, belongings, financial security, and particularly bereavements. This period lasts, hypothetically at least, for the remainder of the person's life and includes the period of rehabilitation. This period is associated with the reactive phenomena with which psychiatrists are familiar and which are described in the literature as post-traumatic reactions.

When the violence of impact has subsided, coherent thought and organized behaviour once again become possible.

An instinctive concern for the self is common immediately after disaster; there may be little awareness of the plight of others. Soon, however, many persons will be able to reassert their concern for their loved ones, and heroic rescue efforts are frequently seen.

Most persons try to estimate the various possibilities for action and to make some kind of realistic adaptation.

No organized or professional aid will be available during this phase. Help can come only from the relatively uninjured survivors. There are usually a few potential leaders who have the ability to grasp quickly the essential information needed for effective action to protect both themselves and others.

The immediate post-impact period is crucial. Here, perhaps more than at any other time, effective action will save lives, diminish disability, reduce abnormal behaviour, and generally cut down the inevitable confusion in any civil defence effort.

The post-traumatic period includes persistent anxiety, fatigue states or depressive reactions, usually with recurrent dreams which repeat the trauma, irritability to noise and surprise, and sometimes conversion hysteria symptoms. Severe reactions require specialized treatment. The important measures (of treatment) include rehabilitation into useful occupation, and the talking out of one's experiences, including one's grief reactions.

Psychological First Aid

Psychological first aid concerns ways of establishing effective human contacts with disturbed persons who have lost touch to some degree with the world as it is.

Treatment should be instituted at the earliest possible moment. Brief methods of treatment should be utilized. Individuals must be urged to return to their group at the earliest possible moment.

When a man's ability to cope with his feelings is shattered, we must not expect him to function normally again almost immediately. When a man's thigh is shattered, no one expects him to walk for a time.

The re-establishment of the familiar, the identification of people as individuals with social roles, and the early recognition of basic social groups, e.g., the family, are essential for the process of recovery. Since so many symptoms arise out of situational factors such as fear for the safety of self and initimates, separation of family members, disruption of normal routines, and anxieties about the future, an effective "treatment" lies in the alleviation of the situations which produced them.

Every able person should be assigned to some definite task and responsibility, no matter how small it is. The fact that they are occupied and feel useful will have great therapeutic value. Even negative feelings of fear, anger, hatred and resentment can be utilized if we channel their expression into activities which promote group survival. The performance of useful tasks, in itself, is a means of overcoming the fears and anxieties generated by the disaster, as well as a means of decreasing damaging psychological effects. The immediate establishment of routine is essential as it creates an atmosphere of control and stability.

Positive Measures That Can Be Taken

1. Minimization of exposure to secondary traumatic stimuli.
2. Rapid re-uniting of families.
3. Restoration of familial and occupational routines.
4. Rapid and efficient efforts at reconstruction and rehabilitation.
5. Measures designed to protect the populace from future danger.

The Attitude for Helpers

Because medical personnel will be fully occupied in caring for the many physical injuries resulting from atomic disaster, psychological casualties will have to be cared for by non-medical workers. These workers should be recruited and trained as part of the C.D. program.

Of great significance is the quality inherent in a person's position in the community which shows "all will be well". The model is the nurse. The nurse has been looked upon as the person who emanates confidence and who will not permit anything untoward to take place; she is the "mother figure" during illness. "Mother figure" qualities should be in evidence at all times. They should subtly supply the atmosphere of "we are in good hands". C.D. workers dealing with psychological aspects of disaster need to know not only the positive measures but also the positive attitude. The example of the positive attitude is the good nurse or good school teacher. Probably most people have this attitude. (It is especially important with children because they take their attitudes from the significant adults around them.)

Summary

The North American literature on the psychology of disaster has been sampled. It concerns factors in stress, need for a plan, and the emotional reactions during impact, recoil and post-traumatic periods. Special attention is given to simple psychological first aid, positive measures, and the best attitude for helpers.

* * * *

Continued from page 6

as well as the CBC, in the federal complex for emergency government and the Regional Emergency Headquarters. These correspondents would obtain information by means of situation reports, briefings and interviews and also would have available to them the copies of the warnings, instructions and advice being broadcast to the public. Their despatches, newscasts and broadcasts by senior members of government would be the main source of public information.

Preparation of warnings, instructions and advice would be the responsibility of civilian and military officers assigned to duties in the various emergency headquarters. For example, warnings to residents of areas threatened or affected by radioactive fallout would be prepared by the Army; advice to farmers concerning cattle and crops by officers of the Department of Agriculture.

As stated above, the means of dissemination for public information and warnings, instructions and advice, would be by broadcasts and the printed word.

In the past, the provision of information to the Canadian people in wartime has been considered important by civil and military authorities alike. But the very nature of a nuclear war involving an attack on North America has made public information one of the factors which well might decide the success or failure of the defence of this continent. Information will reduce panic and fear and, if acted upon, warnings, instructions and advice developed by a trained staff viewing the overall situation would save literally thousands upon thousands of lives and thereby immeasurably assist the civil defence activities of municipalities and the reentry and rescue operations of the Army. This gives both urgency and importance to the public information operations plan. The present plan is not perfect. No plan ever is. But considerable progress has been made towards ensuring that in the event of a nuclear attack authoritative information as well as warnings, instructions and advice would reach the Canadian people.

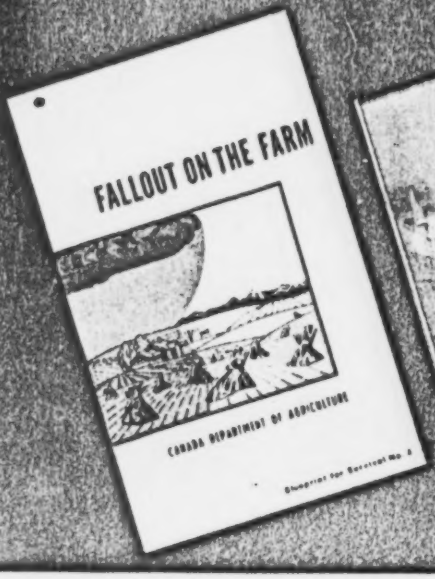
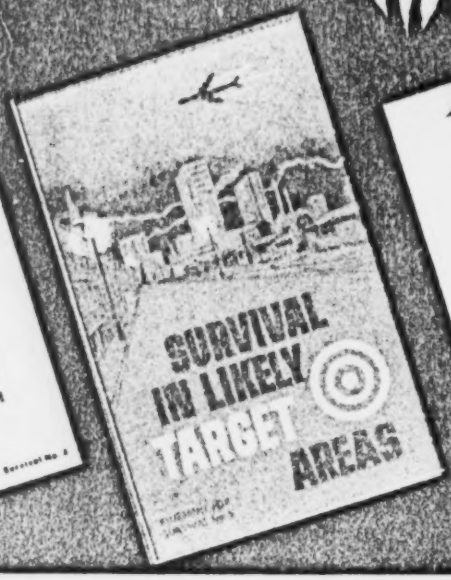
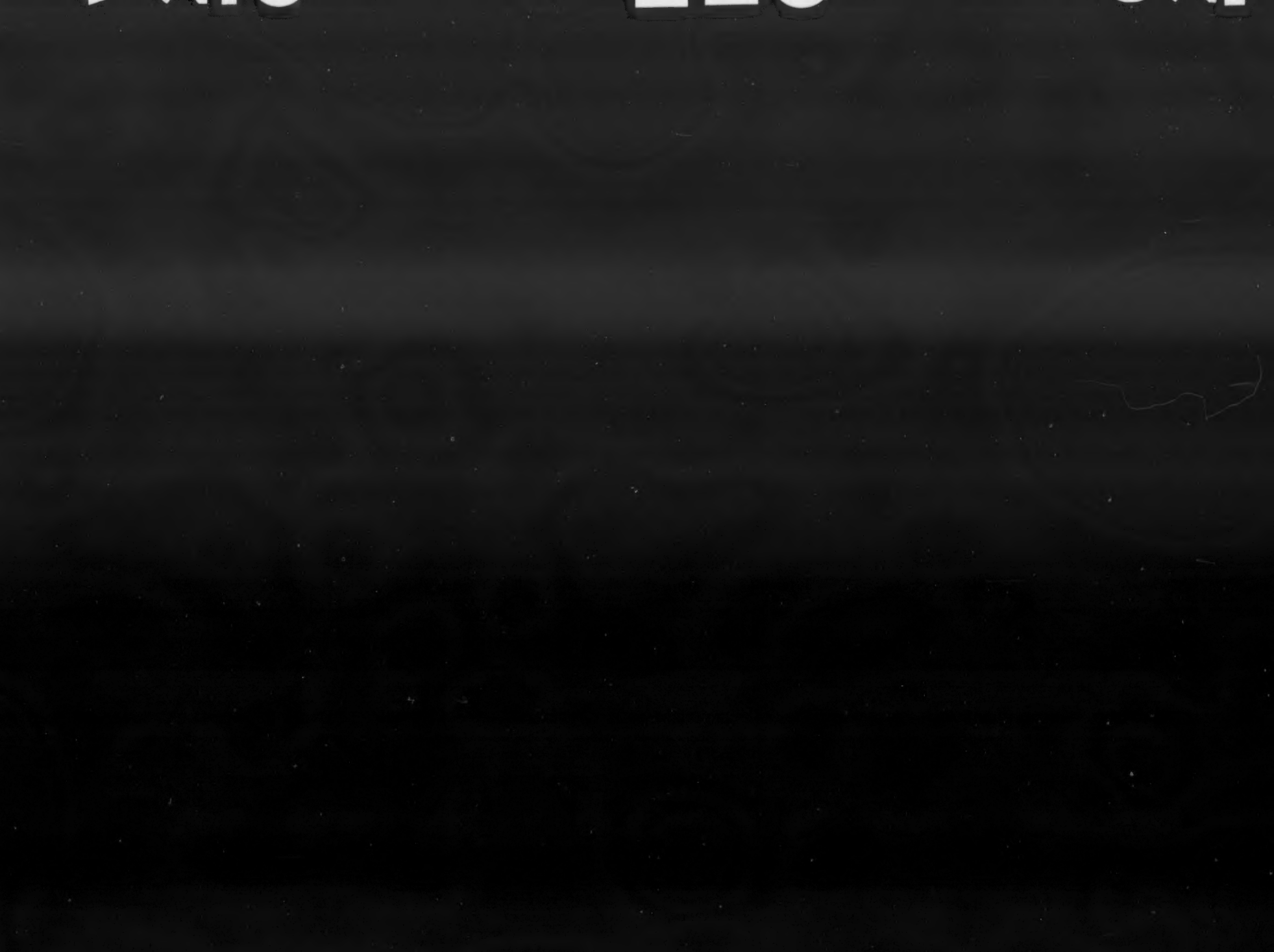
* * * *

Continued from page 8

The whole series of projects for the provision of maps for Survival Operation proved most interesting to those in the Directorate of Military Survey and the Army Survey Establishment that worked on them. One most sincerely hopes that they will never be used for their titled intention. Let us hope instead that they will prove useful in the peaceful development of our urban communities.

* * * *

Copies of the poster shown opposite, reproduced in 3 colours, have been distributed to all provinces. This poster, designed to promote survival literature, contains a box at the bottom (not shown here) in which municipalities can insert additional information.

WHAT WOULD DO?

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